# City of Loma Linda
# Official Report



COUNCIL AGENDA: December 16, 2003

TO: City Council

VIA: Dennis R. Halloway, City Manager

FROM: Deborah Woldruff, AICP
Community Development Director: and,

James Hettrick, Information Systems Director

SUBJECT: Loma Linda Connected Community Program – Request for Adoption of the Program and Related Requirements

## RECOMMENDATION

The recommendation is that the City Council approve Loma Linda Connected Community Program and adopt the Resolution.

## BACKGROUND

Staff has long been interested in developing and establishing a program that would promote telecommunications in the City and support the resident's use of advancements in the industry. The reasons for this are obvious. Loma Linda is a diverse and unique community with strong ties to its religious, educational and healing arts roots. It is the home of the Loma Linda University, Loma Linda University Medical Center, Loma Linda University Childrens Hospital, Loma Linda University Community Hospital, and Jerry L. Pettis Memorial Veterans Medical Center. Local residents tend to be fairly well educated and many have undergraduate degrees. A fair number of residents also have graduate and post-graduate degrees. In comparison to other cities in the East Valley, many of the local residents have home-based businesses and/or telecommute. Given the high percentage of professional people who live and work in the community and the concentration of medical institutions and medical research facilities, Loma Linda is great match for the Connected Community concept.

On August 28, 2003, the City Council approved the Barton Vineyard Project (AGS Spanos Companies) with a Condition of Approval that the project comply with the City's program. Since then, other projects also have been conditioned to meet the Program requirements. Staff has prepared the draft Program document that includes all of the design, install, and product specifications for the Council's consideration (see Attachment A, Resolution).

## ANALYSIS

The Loma Linda Connected Community Program will require that all new development and additions that exceed 50 percent of the original structure and within the Fiber-Optic Master Plan Area comply with the Program requirements. The purpose of the Program is to provide Loma Linda business and residents with opportunities for voice, data, video, multimedia, home automation systems, environmental control, security, audio, television, sensors, alarms, and intercom. The Program document describes and establishes the standardized requirements for residential and commercial telecommunications cabling systems. The initial intent is to connect new development but the long-term goal is to eventually retrofit the entire community.

## ENVIRONMENTAL

The Loma Linda Connected Community Program is exempt from the California Environmental Quality Act (CEQA) pursuant to Section 15303(d) of the CEQA Guidelines. This categorical exemption class applies to the construction of limited, new facilities or structures that support water, sewer, electrical, gas, or other types of utilities or utility extensions.

## FINANCIAL IMPACT

The financial impacts to the City are not known at this time. However, the implementation of the Loma Linda Connected Community Program will increase the costs for residential developers on a per unit basis by approximately $2,700 to $3,000 for the additional equipment, labor, and infrastructure. The increased costs for commercial and other non-residential uses are commensurate. At this time, the Information Systems Department is preparing a full business plan that will be forwarded to the City Council sometime during the first quarter of next year.

## ATTACHMENTS

A. Resolution
   Exhibit 1: The Loma Linda Connected Community Program and Design, Installation and Product Specification document

*I:\Community Connection Program\CC121603 LLCCP sr.doc*

RESOLUTION NO. _____

A RESOLUTION OF THE CITY COUNCIL OF CITY OF LOMA LINDA APPROVING THE LOMA LINDA CONNECTED COMMUNITY PROGRAM AND DESIGN, INSTALLATION AND PRODUCT SPECIFICATION FOR ALL NEW DEVELOPMENT PROJECTS AND ADDITIONS THAT EXCEED MORE THAN FIFTY (50) PERCENT OF THE ORIGINAL STRUCTURE AND WITHIN THE FIBER-OPTIC MASTER PLAN AREA.

WHEREAS, the City has identified a need to provide local residents and businesses with additional options to meet their telecommunication needs; and

WHEREAS, the City has prepared and included in the Loma Linda Connected Community Program a Design, Installation and Product Specification that outlines the program details; and

WHEREAS, said Loma Linda Connected Community Program and Design, Installation and Product Specification will act as a living document allowing for adjustments to facilitate advancements and efficiencies in the technology and its implementation; and

WHEREAS, all new development projects and additions that exceed more than fifty (50) percent of the original structure and within the fiber-optic master plan area will be required to participate in the Program.

NOW, THEREFORE, BE IT RESOLVED that the Loma Linda City Council hereby:

1. Approves the Loma Linda Connected Community Program and Design, Installation and Product Specification referenced and included herein as Exhibit 1; and

2. Certifies that the Loma Linda Connected Community Program and Design, Installation and Product Specification will act as a living document; and

3. Requires that all new development projects, and additions that exceed more than fifty (50) percent of the original structure and within the fiber-optic master plan area participate in the Program.

PASSED, APPROVED AND ADOPTED this 16th day of December 2003 by the following vote:

Ayes:
Noes:
Abstain:
Absent:

_____
Floyd Petersen, Mayor

ATTEST:

_____
Pamela Byrnes-O'Camb, City Clerk

# *The Loma Linda*

# *Connected Community Program*

# *and*

# Design, Installation and Product Specification

Civic Center
25541 Barton Road
Loma Linda, CA 92354

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# 1. INTRODUCTION

## Background

The City of Loma Linda is a diverse and unique community with strong ties to its religious, educational and healing arts roots. It is the home of the Loma Linda University, Loma Linda University Medical Center, Loma Linda University Childrens Hospital, Loma Linda University Community Hospital, and Jerry L. Pettis Memorial Veterans Medical Center. Local residents tend to be fairly well educated and many have undergraduate degrees. A fair number of residents also have graduate and post-graduate degrees. In comparison to other cities in the East Valley, many of the local residents have home-based businesses and/or telecommute. Given the high percentage of professional people who live and work in the community and the concentration of medical institutions and medical research facilities, Loma Linda is great match for the Connected Community concept. The Loma Linda Connected Community Program was developed to meet the existing and future needs of the community and its residents.

## Purpose

The purpose of this document is to standardize requirements for residential telecommunications cabling in The City of Loma Linda. These requirements are based on the facilities that are necessary for existing and emerging telecommunications services. The cabling infrastructure specifications within this Specification are intended to include support for voice, data, video, multimedia, home automation systems, environmental control, security, audio, television, sensors, alarms and intercom. This Specification will be implemented for all new construction, additions exceeding 50 percent of the original structure and within Fiber Optic Master Plan area. The intent of this Document is to establish the general Specifications for a premises structured cabling system, manufactured by BerkTek/Ortronics/Corning, which will meet the voice, video and data communication needs of The City of Loma Linda.

The System, shall incorporate all features and facilities listed in this Specification.

# 2. GENERAL INFORMATION

The City of Loma Linda will implement a new Berk Tek/Ortronics Category 6 copper structured cabling system within each residence of any and all new residential developments. The City of Loma Linda will also implement a new Corning Fiber Optic FTTH OSP cabling infrastructure connecting each new residence in any and all new residential developments to a proposed Main Data Frame (MDF) located within the new development property.

- All cabling and connectivity hardware listed within this document and attachments shall be purchased from Anixter Inc. Anaheim California, or an approved equal by the developer or contractor. This will guarantee compliance with all codes and industry standards. Alternate materials shall

be submitted for approval. No substitutions of equipment or material providers will be accepted without the City of Loma Linda written approval.

- The City of Loma Linda has negotiated with Anixter Inc. Anaheim California to provide the scope of work and estimated bill of materials for each individual development at no cost to the developer.

- Contractors should understand that the issuance of this Specification does not create any obligation on the part of the City of Loma Linda to enter into any contract or undertake any financial obligations with respect to the system referred to herein.

- Contractor acknowledges that the City of Loma Linda will rely on contractor's ability, expertise and knowledge of the system. Contractor shall be obligated to exercise the highest standard of care in performing its obligations. Contractor shall demonstrate to City of Loma Linda's satisfaction that it is of sound financial condition and is adequately bonded and insured.

- If additions, deletions, modifications or clarifications to the Specification become necessary, the changes to this Specification will be noted in writing.

- In the same manner as the infrastructure for water, sewer, storm drain, street lights, and traffic signals, the fiber-optic cabling and conduit pathways will be owned and maintained by the City of Loma Linda after the developer completes the installation.

## 3. APPLICABILITY

This Specification applies to telecommunications premises cabling systems and the related pathways and spaces for single and multi-tenant residential buildings. This

Specification specifies cabling systems intended to support a wide range of telecommunications applications in the residential environment.

The Specification applies to the telecommunications cabling within or between structures. This includes the cabling within a living unit and the backbone cabling.

This Specification is intended to be in conformance with Part 68 of the FCC Rules and Regulations, the National Electrical Code, and the National Electrical Safety Code.

Cabling shall comply with requirements in this Specification, which meets or exceeds all current local codes and regulations.

This Specification is in compliance with local code. The reader should also be aware of applicable codes that may impact the use of this Specification.

## 4. LIFE OF THIS SPECIFICATION

This Specification is a living document. The criteria contained in this Specification are subject to revisions and updating as warranted by advances in building construction techniques and telecommunications technology.

## 5. NORMATIVE REFERENCES

The following Standards contain provisions that, through reference in this text, constitute provisions of this Specification. At the time of publication of this Specification, the editions were valid. All Standards are subject to revision; parties to agreements based on this Specification are encouraged to investigate the possibility of applying the most recent editions of Standards indicated. ANSI and TIA maintain registers of currently valid national Standards published by them. Copies of these standards can be obtained on-line at http://www.tiaonline.org/, http://www.bicsi.org/ and http://www.ieee.org.

- ANSI/EIA/TIA-455-A-1991, Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
- ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable
- ANSI/ICEA S-87-640-1992, Fiber Optic Outside Plant Communications Cable
- ANSI/ICEA S-89-648-1993, Telecommunications Aerial Service Wire
- ANSI/IEEE C2-2002, National Electrical Safety Code
- ANSI/NFPA 70-2002, National Electrical Code
- ANSI/TIA/EIA-492AAAA-A-1998, Detail Standard for 62.5 mm Core Diameter/125 mm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers
- ANSI/TIA/EIA-492CAAA-1998, Detail Standard for Class IVa Dispersion-Unshifted Singlemode Optical Fibers
- ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7
- ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A
- ANSI/TIA/EIA-570-B-Draft 2-May/2003, Residential Telecommunications Infrastructure Standard
- ANSI/TIA/EIA-568-B, Additional Transmission Performance Standard for 4-Pair 100 Ω Category 6 Cabling
- ANSI/TIA/EIA-569-A-1998, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding

- ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Interconnector Intermateability Standard

- ANSI/TIA/EIA-606-1993, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

- ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications

- ANSI/TIA/EIA-758, 1999 Customer-owned Outside Plant Telecommunications Cabling Standards

- IEC 60603-7, 1996, Detail Standard for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Features Bellcore Generic Requirements and the Society of Cable Telecommunications Engineers, Inc, document which are not ANSI approved, are specified in this Standard. The following is a list of non-Standardized references.

- Bellcore GR-1503-CORE, March 1995, Bellcore Generic Requirements for Coaxial Connectors (Series 59, 6, 7 and 11)

- SCTE, IPS-SP-001, June 13, 1996, Flexible R.F. Coaxial Drop Cable

- SCTE, IPS-SP-100, January 14, 1997, Standard for Trunk, Feeder and Distribution Coax Cable

- SCTE, IPS-SP-401, October 10, 1997, "F" Port (Male Feed Thru) Physical Dimensions

- SCTE, IPS-SP-404, October 10, 1997, "F" Connector (Male Indoor) Installation and Performance

## 6. SYSTEM SUPPORT

**The system shall support:**

- Analog and digital voice, data, video, multimedia, home automation systems, environmental control, security, audio, television, sensors, alarms and intercom applications on a common cabling platform.

- Cover its capacity and functionality with minimum components and be flexible and capable of including new facilities or technologies as they become required or available.

- As new technologies evolve, the need for a balanced and redundant cabling infrastructure to handle these high data rates will become more crucial. All major structured cabling installations for City of Loma Linda must be certified to the requirements of this specification and the cable and connecting hardware manufacturers Specifications contained herein.

## 7. STRUCTURED CABLING SYSTEM

The Structured Cabling System (SCS) shall consist of any or all of the following six subsystems in accordance with ANSI/TIA/EIA and BICSI guidelines and shall consist of cable and connecting hardware manufactured by BerkTek/Ortronics and Corning. For direct assistance in interpreting telecommunications specifications, the services of a Registered Communications Distribution Designer (RCDD) certified by the Building Industry Consulting Service International (BICSI) is recommended:

## 8. RESIDENTIAL CABLING SYSTEM REQUIREMENTS

### 8.1 General

- The system established in this Specification is based upon services that are expected to be supported within each residential unit and to assist in the selection of the cabling infrastructure.
- For home automation and security systems cabling requirements, refer to the manufacturer's recommendations.
- Each cabled location provides a structured cabling system that meets the specified requirements for advanced, and multimedia telecommunications services.
- This provides for both current and developing telecommunications services. As an example, this provides for telephone, satellite, community antenna television (CATV) and data services.
- It specifies twisted-pair cable and coaxial cable placed in a star topology.
- Minimum horizontal cabling requirements consist of two (2) 4-pair UTP Berk Tec Category 6 horizontal cables, one (1) Berk Tec 75-ohm coaxial horizontal cable from Distribution Center Box to each specified outlet location.
- Access service provider connectivity minimum requirements one (1) Berk Tec Category 6 cabling and one (1) Berk Tec 75-ohm coaxial cable from external service provider box though conduct provided to Distribution Center Box.
- Connectivity minimum requirements consist of one (1) Ortronics 3-port faceplate, two (2) Ortronics Category 6 connectors, one (1) Berk Tec 75-ohm coaxial connector at each specified outlet location.
- UTP cabling performance requirements are listed in Section 11 of this document.
- Patch Cord performance requirements are listed in Section 12 of this document.
- Connectivity performance requirements are listed in Section 13 of this document

## 9. SINGLE RESIDENTIAL UNIT CABLING SYSTEM

The following is a sequential trace of the cabling system, from the Distribution Center Box (DCB) to the terminal equipment in a single residential unit. The system requirements in this section are applicable to all media types described above. Grounding and bonding shall be performed in accordance with applicable electrical codes.

## 9.1 Distribution Center Box (DCB) - Requirement: See Attached Diagram and Material List.

### 9.1.1 General

- A Distribution Center Box (DCB) shall be provided within each residence. The DCB is a cross-connect facility used for the termination and connection of horizontal cables and equipment cords.
- The DCB is used for connection of access providers to the residence and to facilitate moves, adds and changes of premises cabling within the residence.
- Contractor must provide a 2" conduit pathway from the DCB to an outside dual gang flush mount box with cover to facilitate the entrance of access provider media to each residence, i.e.: Telephone/CATV.
- Contractor must connect all service provider boxes to the outside dual gang flush mount box with a minimum 1 inch conduit.
- Space should be allocated adjacent to or within the DCB for the installation of a surge protection device for each conductive cable entering or leaving the building.
- Access to the building electrical ground shall be provided within 1.5 m (5 ft) of the DCB, and in accordance with applicable codes.
- The DCB may consist of a passive cross-connect facility, or an active cross-connect facility, or both. As an example, an active cross-connect facility may be embodied in a residential gateway.

### 9.1.2 Location requirements for the distribution device

- The DCB shall be installed inside the tenant's space in a location that is accessible for cabling maintenance.
- The location should be centralized within the tenant space, where practicable, to minimize the length of outlet cables. Required: Space allocation in the master bedroom closet.
- The DCB shall not be mounted on any exterior wall or garage wall.
- The DCB and associated equipment shall be recessed between stud spaces.

### 9.1.3 Wall space allocation for a distribution device and associated equipment

- Space allocation for the DCB and associated equipment is to be 15.10" Wide, with a minimum overall height of at least 32".

### 9.1.4 Electrical power

- Electrical power will be required at the DCB.
- A dedicated 15 A, 120 Vac nominal, non-switchable duplex electrical outlet shall be provided within the DCB.
- The location and height of the electrical outlet should be appropriate for the DCB and associated equipment being installed, and shall be in compliance with applicable codes.

## 9.2 Horizontal Cables

Horizontal Cables provide the transmission path from the DCB to the telecommunications outlet/connector. A horizontal cable may be connected through a transition point or consolidation point (TIA/EIA TSB-75).

- The length of each horizontal cable shall not exceed 90 m (295 ft). The 90 m (295 ft) length allows an operational length of 100 m (328 ft) including patch cords or equipment cords.
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### 9.2.1 Recognized cables Requirement: See Attached Material List.

Recognized horizontal cable includes:

- Berk Tec 4-Pair UTP Category 6 (ANSI/TIA/EIA-568-B)
- Corning Singlemode fiber (ANSI/TIA/EIA-492CAAA) (intended for outside plant and special case future applications).
- Series 6 coaxial (SCTE IPS-SP-001)

### 9.2.2 Cabling topology for outlet/connectors

- Horizontal cabling shall be placed in a star topology.

### 9.2.3 Outlet locations Requirement: See Attached Material List.

- A minimum of one outlet location shall be cabled within each of the following rooms or similar living spaces as determined by the Community Development Director.
-

kitchen
bedroom
den/study
desk/tech area
living room
dining room

- A minimum of two outlet locations shall be cabled within each of the following rooms.
family/great room a minimum of one must be located in the media center area.
master bedroom on opposite walls.

- A sufficient number of telecommunications outlet locations should be planned to prevent the need for extension cords.

- Additional outlet locations should be provided so that no point along the floor line in any wall space is more than 7.6 m (25 ft), measured horizontally, from an outlet location in that space.

- Outlet mounting heights shall be in accordance with applicable codes.

### 9.2.4 Cable pathways

- For new construction, a 2" conduit pathway shall be installed for future placement of satellite feeder cables. Between the DCB and the attic space.

- Horizontal pathways will expose the cable for any and all new construction. (Typically, exposed cabling is accomplished by placing the cables through holes in wall studs and ceiling joists before the walls and ceilings are sheathed).

## 9.3 Telecommunications outlet/connector

The telecommunications outlet/connector shall be Ortronics Category 6 and compatible with the media provided at that location.

- Some networks or services require application-specific electrical components (e.g., splitters, amplifier, impedance matching devices) at the telecommunications outlet/connector.

- These application-specific electrical components shall be placed external to the telecommunications outlet/connector.

## 9.4 Equipment cords and patch cords

- Equipment cords extend from the telecommunications outlet location to the terminal/equipment connector. These cords are customer provided. Ortronics Category 6 Equipment Cords are recommended to maintain Category 6 performance.

- Patch cords or jumpers are used for interconnections or cross-connections at the DCB. Ortronics Category 6 patch cords are to be provided as part of this Specification.

- For each channel, a total of 10 m (33 ft) is allowed for equipment cords and patch cords.

## 9.5 Main Data Frame

- The MDF or main terminal space may be co-located with the entrance facility. It may also be used to house active equipment.

- The MDF or main terminal space may house the demarcation point for access providers and campus backbone cable.

- The associated pathways, protection devices, and any other equipment needed to provide a connection from the access providers' access lines may also be located in the MDF or main terminal space.

- An MDF requires other support facilities such as power, and

heating, ventilation, and air conditioning (HVAC). For more information on Control Building/Equipment Rooms, see ANSI/TIA/EIA-569-A.

- For proper sizing of Control Building/Equipment Room, refer to the ANSI/EIA/TIA 569-A Standard.

### 9.6 Interbuilding telecommunications backbone pathways

- Interbuilding telecommunications backbone pathways provide a means of interconnecting separate buildings and consist of underground, buried, aerial, and tunnel pathways.
- The City of Loma Linda Community Development Department must approve all routing of Interbuilding telecommunications backbone pathways during the planning process.
- Minimum conduit sizing for all out side plant conduit shall be 2 inch.
- Minimum splice node vault size shall be 24"x36"x36"
- For more information on interbuilding telecommunications backbone pathways, see ANSI/TIA/EIA-758.

### 9.7 Interbuilding Fiber-Optic Backbone

- A minimum of one continuous strand single mode fiber-optic cable shall be provided from the MDF to each individual residence.
- Each strand of single mode fiber-optic cable shall have connectors installed on both ends. Connector shall be SC Type.
- At each individual residence a fiber storage spool shall be provided and utilized within the DCB.
- At the MDF a minimum of one 19" x 7' industry standard rack shall be provided and installed. Mounted and braced as per applicable standards and local codes.
- At the MDF all individual single mode fiber optic strands shall be routed and connected to a corning rack mount fiber shelf. Capacity of shelf to be determined by count of fiber strands.
- All fiber-optic cable shall be routed and installed from MDF to individual residences via a minimum 2" industry standard conduit.
- Maximum fiber-optic cable outside diameter not to exceed 1 inch in each 2 inch. conduit.
- An industry standard vault shall be provided for each 8 homes. All vaults shall be sized to accommodate fiber optic splice enclosures.
- All single mode fiber-optic strands must be tested, certified and labeled in accordance with industry standards after installation and termination.
- The developer shall be responsible to provide all material and labor to accommodate all necessary fiber-optic splice hardware.
- The developer shall be responsible to provide two, 4" conduits from MDF to closest City owned fiber optic backbone connection point. This is to be determined at the plan check phase.

## 10. MULTI-TENANT/CAMPUS/COMMERCIAL INFRASTRUCTURE

### 10.1 General

The following is a sequential trace of the cabling system for the multi-tenant/campus infrastructure from the new Control Building (MDF) to the Distribution Center Box (DCB) located in each individual residence in a campus environment.

- The Control Building will be located on the development property at a TBD position.
- The Distribution Center Box (DCB) will be located in the individual residence or tenant space.
- Access to shared-use space shall be controlled by the building owner or agent.
- Where the total length of cabling from the demarcation point to the furthest outlet exceeds 150 m (492 ft), the access provider shall be notified at the design stage to accommodate transmission requirements.
- Grounding and bonding shall be performed in accordance with applicable electrical codes. For multi-tenant buildings, ANSI/TIA/EIA-607 provides additional bonding and grounding information.

### 10.2 Main Data Frame

- The (MDF) or main terminal space may be co-located with the entrance facility. It may also be used to house active equipment.
- The MDF or main terminal space may house the demarcation point for access providers and campus backbone cable.
- The associated pathways, protection devices, and any other equipment needed to provide a connection from the access providers' access lines may also be located in the MDF or main terminal space.
- The MDF requires other support facilities such as power, and heating, ventilation, and air conditioning (HVAC). For more information on Control Building/Equipment Rooms, see ANSI/TIA/EIA-569-A.
- For proper sizing of MDF/Equipment Room, refer to the ANSI/EIA/TIA 569-A Standard.

### 10.3 Equipment room

- In multi tenant dwellings, an equipment room may house the entrance facility, the main terminal space, and a floor serving terminal.
- An equipment room typically houses more equipment than a floor serving terminal and it has different space requirements.
- An equipment room requires other support facilities such as power, and heating, ventilation, and air conditioning (HVAC). For more information on equipment rooms, see ANSI/TIA/EIA-569-A.
- For proper sizing of equipment room, refer to the ANSI/EIA/TIA 569-A Standard.

### 10.3 Floor-serving terminal

- The floor-serving terminal is the space where backbone and horizontal cables terminate.

- A floor-serving terminal should be located on each floor, or every third floor, thus serving the floor it is on and the floors above and below.

- The floor serving terminal should be in a common area and easily accessible. The minimum size of the space shall be in accordance with Table 4.

- The floor-serving terminal may be required to be expanded in size to accommodate additional hardware.

**Table 4 – Minimum space for floor serving terminal**

- Minimum space for first five tenant units
  - 370 mm (14.5 in) wide
  - 610 mm (24 in) high
  - 775 mm (30.5 in) wide
  - 610 mm (24 in) high

- Minimum additional space per tenant unit
  - 32270 sq. mm
  - (50 sq. in)
  - 64540 sq. mm
  - (100 sq. in)

- If active equipment is placed within the floor-serving terminal, a dedicated, un-switched 15 A, 120 Vac nominal outlet shall be provided within 1.5 m (5 ft) of the floor serving terminal.

- The height of the electrical outlet should be appropriate for the floor serving terminal being installed and shall be in compliance with applicable codes.

## 10.4 Backbone pathways

### 10.4.1 General

- Within buildings, consideration should be given to establishing spare pathway capacity (i.e., conduit w/pull-string) for future media additions or modifications that would be difficult or impossible to cable.

### 10.4.2 Intrabuilding backbone pathways

- Intrabuilding pathways typically employ conduits, sleeves, slots, or cable trays (w/pull-string) as a means for placing backbone cable.

- A minimum of one (1) (#4) trade size conduit or sleeve (w/pull-string) shall be provided for each backbone pathway where backbone cable extends from the main terminal space to a floor serving terminal space.

- Where cable bundles with an equivalent diameter of 25 mm (1 in) or less extend through each apartment closet, a minimum of one (1) (1-1/2) trade size conduit or sleeve shall be provided for the backbone pathways.

- For more information on intrabuilding backbone pathways, see

ANSI/TIA/EIA-569-A.

### 10.4.3 Interbuilding telecommunications backbone pathways

- Interbuilding telecommunications backbone pathways provide a means of interconnecting separate buildings and consist of underground, buried, aerial, and tunnel pathways.
- Minimum conduit sizing for all out side plant conduit shall be 2 inch.
- Minimum splice node vault size shall be 24"x36"x36".
- For more information on interbuilding telecommunications backbone pathways, see ANSI/TIA/EIA-758.

## 10.5 Backbone cabling

### 10.5.1 Recognized cables

Recognized backbone cables include:

- Corning Singlemode fiber (ANSI/TIA/EIA-492CAAA)
- Berk Tec Hard-line coaxial (SCTE IPS-SP-100)
- Berk TecSeries 6 coaxial (SCTE IPS-SP-001)

### 10.5.2 Topology

- A star topology should be implemented for optical fiber backbone cabling.
- Coaxial backbone cable may be implemented using a star topology.

### 10.5.3 Interbuiding cabling protection

- When buildings are connected with interbuilding cabling, the applicable fusing and voltage protection codes shall be followed.

### 10.5.4 Interbuilding Fiber-Optic Backbone

- A minimum of one continuous strand single mode fiber-optic cable shall be provided from the MDF to each individual residence.
- Each strand of single mode fiber-optic cable shall have connectors installed on both ends. Type of connector TBD for each development.
- At each individual residence a fiber storage spool shall be provided and utilized within the DCB.
- At the MDF a minimum of one 19" x 7' industry standard rack shall be provided and installed. Mounted and braced as per applicable standards and local codes.
- At the MDF all individual single mode fiber optic strands shall be routed and connected to a corning rack mount fiber shelf. Capacity of shelf to be determined by count of fiber strands.
- All fiber-optic cable shall be routed and installed from MDF to individual residences via a minimum 2" industry standard conduit.
- Maximum fiber-optic cable outside diameter not to exceed 1 inch in each 2 inch. conduit. For fiber optic cable diameter exceeding 1", the option of installing 4" conduit is available.
- An industry standard vault shall be provided for each 8 homes. All vaults shall be sized to accommodate fiber optic splice enclosures.
- All single mode fiber-optic strands must be tested, certified and labeled in accordance with industry standards after installation and termination.

- The developer shall be responsible to provide all material and labor to accommodate all necessary fiber-optic splice hardware.
- The developer shall be responsible to provide two, 4" conduits from MDF to closest City owned fiber optic backbone connection point. This is to be determined at the plan check phase.

# 11. APPROVED CATEGORY 6 CABLE PERFORMANCE (Reference Information)

## Scope

This specification applies to solid 4-pair unshielded twisted-pair (UTP) communications cables and stranded patch cordage manufactured by Berk-Tek., NEC types CM, CMG, CMR, CMP, MP, MPG, MPR and MPP, and where applicable, CSA FT-4 and FT-6. Zero Halogen constructions are also included.

## Normative References

### Reference Documents

The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling document. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.
ANSI/ICEA S-90-661
CSA
UL 444
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
NEC, NFPA70
NEMA WC-63/66

### Applicable Testing Standards

Testing shall be in accordance with the following standards:
ASTM D 4566-94, Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable, 1994
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-1, Propagation Delay and Delay Skew Specifications for 100 Ω 4-pair cable, 1997
ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A, 1998
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

## General Requirements

### Applicable Cables

Levels of performance apply to 4 pair unshielded twisted pair cables. A shielded version, if allowed, shall comply with the performance requirements of the applicable Level.

### Minimum Performance Requirements

All cables shall meet the minimum performance requirements of the latest applicable standards defined above.

### Minimum Levels Requirements

The cable for each purchasing Level shall meet the performance requirements of all lower Levels.

### Virgin Materials

Only Virgin materials shall be used in the construction of Levels cables

### Plenum Rated Cables

Plenum-rated cables shall use 100% FEP for the insulation except where it is proven that the cable constructed with alternate materials meets or exceeds the electrical performance of FEP.

### Quality Assurance

The manufacturer of Level cables shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

### Labeling of UTP Cable and Patch Cordage

The following information will be repetitively printed every 12-24 inches on the cable jacket: Manufacturer's name, brand, gauge, pair count, NEC type (CSA in Canada), part number, other standards compliance rating, and footage marker.

### Packaging of UTP Cable

Standard packaging is 1,000 feet, one continuous length on a reel, in a reel-less box or on a reel in a box. All cables shall be shipped on 42" x 48" pallets, and shall not be stacked higher than 48". All pallets shall contain the same color cable with the same footage marked with the appropriate part number.

### Measurement Precautions

Transmission measurements shall be performed on 100m (328 ft.) cable samples cut from the reel or package. Impedance matching balun terminations shall be used in conjunction with an RF vector network analyzer to acquire all data. When preparing the cable samples for measurement, no more than 38 mm (1.5 in.) of jacket shall be removed on either end of the sample. The twist rate shall be maintained as much as possible into the balun test terminals. When a load termination is required, a precision metal film or chip 100 $\Omega \pm 1\%$ resistor shall be used to terminate each cable pair.

## Category 6 Cable

## Reference Documents

In addition to the requirements listed above and below, Category 6 cables shall meet the requirements of:

ANSI/TIA/EIA-568-A-5 Category 5e
ANSI/TIA/EIA-568-B Category 6
ISO/IEC 11801 Category 5 & 6

## Performance Requirements

### Category 6 Cable – Highest Test Frequency

400 MHz minimum (all parameters)

### Category 6 Cable – Input Impedance

Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2. Category 6 input impedance shall be swept out to 400 MHz and meet the following:

| FREQUENCY (MHz) | UPPER INPUT IMPEDANCE LIMIT (Ohms) | LOWER INPUT IMPEDANCE LIMIT (Ohms) |
|---|---|---|
| 1 | 122 | 82 |
| 10 | 111 | 90 |
| 20 | 111 | 90 |
| 400 | 124 | 81 |

The above limits describe the boundaries of an envelope within which the swept curve must fit.

### Category 6 Cable – Minimum Pair-to-Pair NEXT and ELFEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | PAIR-TO-PAIR NEXT LOSS (dB) | PAIR-TO-PAIR ELFEXT LOSS (dB) |
|---|---|---|
| 1 | 75.3 | 68.8 |
| 10 | 60.3 | 48.8 |
| 20 | 55.8 | 42.7 |
| 31.25 | 52.9 | 38.9 |
| 100 | 45.3 | 28.8 |
| 150 | 42.7 | 25.2 |

| | | |
|---|---|---|
| 200 | 40.8 | 22.7 |
| 250 | 39.3 | 20.8 |
| 300 | 38.2 | 19.2 |
| 350 | 37.2 | 17.9 |
| 400 | 36.3 | 16.7 |

### Category 6 Cable – Minimum Power Sum NEXT and ELFEXT

Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | POWER SUM NEXT LOSS (dB) | POWER SUM ELFEXT LOSS (dB) |
|---|---|---|
| 1 | 73.3 | 65.8 |
| 10 | 58.3 | 45.8 |
| 20 | 53.8 | 39.7 |
| 31.25 | 50.9 | 35.9 |
| 100 | 43.3 | 25.8 |
| 150 | 40.7 | 22.2 |
| 200 | 38.8 | 19.7 |
| 250 | 37.3 | 17.8 |
| 300 | 36.2 | 16.2 |
| 350 | 35.2 | 14.9 |
| 400 | 34.3 | 13.7 |

### Category 6 Cable – Maximum Attenuation, Minimum Pair-to-Pair ACR and Power Sum ACR

Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | ATTENUATION (dB)* | PAIR-TO-PAIR ACR (dB) | POWER SUM ACR (dB) |
|---|---|---|---|
| 1 | 2.0 | 73.3 | 71.3 |
| 10 | 6.0 | 54.3 | 52.3 |
| 20 | 8.5 | 47.3 | 45.3 |
| 31.25 | 10.7 | 42.2 | 40.2 |
| 100 | 19.9 | 25.4 | 23.4 |
| 150 | 24.9 | 17.8 | 15.8 |

| | | | |
|---|---|---|---|
| 200 | 29.2 | 11.6 | 19.6 |
| 250 | 33.0 | 6.3 | 4.3 |
| 300 | 36.6 | 1.5 | -0.5 |
| 350 | 40.0 | -2.9 | -4.9 |
| 400 | 43.2 | -6.9 | -8.9 |

MC. *Attenuation for Category 6 stranded patch cordage is allowed to be up to 10% greater.*

**Category 6 Cable – Minimum ACR Frequencies @ 0.0 dB and 10 dB**

- 10 dB @ 228 MHz (100 meter pair–pair NEXT)
- 0 dB @ 344 MHz (100 meter pair–pair NEXT)
- 10 dB @ 208 MHz (100 meter power sum NEXT)
- 0 dB @ 319 MHz (100 meter power sum NEXT)

**Category 6 Cable – Minimum Return Loss (at 100 meters)**

- 26.0 dB @ 10 MHz
- 25.0 dB @ 31.25 MHz
- 23.5 dB @ 62.50 MHz
- 22.5 dB @ 100 MHz

**Category 6 Cable – Longitudinal Conversion Loss (LCL)**

(Reserved for future use when the proper test procedure is developed by ASTM.)

**Category 6 Cable – Maximum Skew**

25 ns at 100 meters

**Category 6 Cable – Maximum Attenuation**

43.2 dB @ 400 MHz

## 12. APPROVED PATCH CORDS

### Scope

This section applies to 100 ohm stranded 4-pair UTP patch cordage in various lengths terminated with eight conductor modular RJ45 or IDC type plugs. Manufactured by **Ortronics**, Inc.

### Normative References

**Reference Documents**

The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling document. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.

CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
ISO/IEC 60603-7

### Applicable Testing Standards

Testing shall be conducted in accordance with the following standards:
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-4, Production Modular NEXT Loss Test Method and Requirements for Unshielded Twisted Pair Cabling, 1999
ATS Anixter Test Specification ATS 01.01 for Non-Destructive Testing of Assembled Patch Cords

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

## General Requirements

### Applicable Hardware

Levels of performance apply to patch cords used with 100 ohm, 4 pair Unshielded UTP Cabling Systems. A shielded version, if offered, shall comply with the performance requirement of the applicable level.

### Quality Assurance

The manufacturer of Level hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

### Labeling of Patch Cords

The following information will be repetitively printed every 12-24 inches on the cable jacket: Manufacturer's name, brand, gauge, pair count, NEC type (CSA in Canada), part number, and other standards compliance ratings.

### Measurement Precautions

Transmission testing shall be conducted on representative samples of the manufacturer's shortest, median, and longest length cords received directly from Anixter's product inventory. The following tables provide reference numbers at specific discrete frequencies for 3 ft., 10 ft., and 25 ft. patch cords. The selected range of patch cord lengths is intended to provide baseline numbers for evaluating patch cord NEXT at varying lengths.

## Category 6 Patch Cords
## Performance Requirements

### Category 6 Patch Cord – Highest Test Frequency

Swept to 250 MHz minimum.

### Category 6 Patch Cord – Minimum Pair-to-Pair NEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | PAIR-TO-PAIR NEXT LOSS 3 ft. cord Limit | PAIR-TO-PAIR NEXT LOSS 10 ft. cord Limit | PAIR-TO-PAIR NEXT LOSS 25 ft. cord Limit |
|---|---|---|---|

| | (dB) | (dB) | (dB) |
|---|---|---|---|
| 1 | 65.0 | 65.0 | 65.0 |
| 10 | 60.0 | 59.9 | 59.7 |
| 20 | 54.0 | 54.0 | 53.9 |
| 31.25 | 50.2 | 50.2 | 50.2 |
| 100 | 40.3 | 40.4 | 40.8 |
| 150 | 36.8 | 37.1 | 37.6 |
| 250 | 32.5 | 32.9 | 33.7 |

### Category 6 Patch Cord – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | RETURN LOSS (dB) |
|---|---|
| 1 to 20 | 25 |
| 31.25 | 23 |
| 62.5 | 20 |
| 100 | 18 |
| 250 | 14 |

## 13. APPROVED CONNECTING HARDWARE PERFORMANCE

### Scope

This section applies to 100 ohm UTP connecting hardware. Manufactured by Ortronics.

### Normative References

#### Reference Documents

All connecting hardware shall meet, as a minimum, all the requirements including the electrical and mechanical performance requirements of:
CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
NEC, NFPA70

### Applicable Testing Standards

Testing shall be conducted in accordance with the following standards:
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999
ISO/IEC 11801

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

## General Requirements

### Applicable Hardware

Levels of performance apply to connecting hardware used with 100 ohm, 4 pair Unshielded UTP Levels Type Cables. A shielded version, if offered, shall comply with the performance requirement of the applicable level.

### Quality Assurance

The manufacturer of Level hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

### Measurement Precautions

Transmission testing shall be conducted on representative samples received directly from Anixter's product inventory. The normative annexes C, D, E and F of the ANSI/TIA/EIA-568-A-5 shall be adhered to when quantifying connecting hardware.

## Category 6 Connecting Hardware Performance Requirements

### Category 6 Hardware – Highest Test Frequency

Swept to 250 MHz minimum.

### Category 6 Hardware – Minimum Pair-to-Pair NEXT, Power Sum NEXT and Maximum Attenuation

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Attenuation shall not be more than the maximum numbers shown in the following table.

| FREQUENCY (MHz) | PAIR-TO-PAIR NEXT LOSS (dB) | POWER SUM NEXT LOSS (dB) | ATTENUATION (dB) |
|---|---|---|---|
| 1 | 94.0 | 90.0 | 0.02 |

| | | | |
|---|---|---|---|
| 10 | 74.0 | 70.0 | 0.06 |
| 20 | 68.0 | 64.0 | 0.09 |
| 31.25 | 64.1 | 60.1 | 0.11 |
| 100 | 54.0 | 50.0 | 0.20 |
| 150 | 50.5 | 46.5 | 0.24 |
| 200 | 48.0 | 44.0 | 0.28 |
| 250 | 46.0 | 42.0 | 0.32 |

### Category 6 Hardware – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | RETURN LOSS (dB) |
|---|---|
| 1 to 25 | 35.0 |
| 31.25 | 34.1 |
| 62.5 | 28.1 |
| 100 | 24.0 |
| 150 | 20.5 |
| 200 | 18.0 |
| 250 | 16.0 |

# 14. CHANNEL PERFORMANCE

## Scope

This section further defines the complete end-to-end channel requirements for the Levels Channel 7 solution manufactured by Berk Tec, Inc. Channel compliance is only applicable following successful compliance to individual component Levels in this specification. This section specifies the minimum requirements that cables, connecting hardware and assembled patch cords must meet when combined into a full cabling system, in order to reach compliance with the Anixter Levels Channel Program.

## Normative Reference

### Reference Documents

The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling document. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.

ANSI/ICEA S-90-661
CSA
UL 444
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
NEC, NFPA70
NEMA WC-63/66

In addition to the requirements shown above, Category 6 cables shall previously meet the requirements of:

ANSI/TIA/EIA-568-A-5 Category 5e
ANSI/TIA/EIA-568-A Category 5

ISO/IEC 11801 Category 5 & 6
All connecting hardware and patch cords shall previously meet, as a minimum, all the requirements including the electrical and mechanical performance requirements of:
CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
ISO/IEC 60603-7
CENELEC EN50173: 1995
NEC, NFPA70

### Applicable Testing Standards

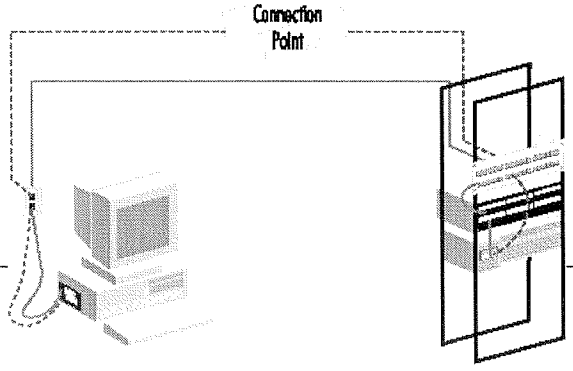
Testing of individual components and channel shall be conducted in accordance with the following standards:
ASTM D 4566-94, Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable, 1994
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-1, Propagation Delay and Delay Skew Specifications for 100 Ω 4-pair cable, 1997
ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A, 1998
ANSI/TIA/EIA-568-A-4, Production Modular NEXT Loss Test Method and Requirements for Unshielded Twisted Pair Cabling, 1999
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999
ANSI/TIA/EIA-TSB 67, Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems, 1999
ATS Anixter Test Specification ATS 01.01 for Non-Destructive Testing of Assembled Patch Cords
ISO/IEC 11801

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

## Requirements

### Applicable Channels

Levels of performance apply to 4-pair unshielded twisted pair cables, assembled patch cords and connecting hardware used with 100 ohm, 4-pair Unshielded UTP Levels Type Cables. A shielded version, if allowed, shall comply with the performance requirements of the applicable Level. The Anixter channel will consists of an equipment patch cord, information outlet, horizontal cabling (90m) with a transition point near the information outlet (I/O), two telecom closet connection points and patch cords for a total of 4 connection points, as shown below.



### Quality Assurance

The manufacturers of Level cables and hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. Anixter also maintains an ongoing program of random sample compliance testing of all Levels products.

## Category 6 Channel

## Category 6 Channel – Performance Requirements

### Category 6 Channel – Highest Test Frequency

250 MHz minimum (all parameters)

### Category 6 Channel – Minimum Pair-to-Pair NEXT and ELFEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | PAIR-TO-PAIR NEXT LOSS (dB) | PAIR-TO-PAIR ELFEXT LOSS (dB) |
|---|---|---|
| 1 | 73.5 | 63.8 |
| 10 | 57.3 | 43.8 |
| 20 | 52.3 | 37.8 |
| 31.25 | 49.1 | 33.9 |
| 100 | 40.5 | 23.8 |
| 150 | 37.5 | 20.3 |
| 200 | 35.3 | 17.8 |
| 250 | 33.7 | 15.8 |

### Category 6 Channel – Minimum Power Sum NEXT and ELFEXT

Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | POWER SUM NEXT LOSS (dB) | POWER SUM ELFEXT LOSS (dB) |
|---|---|---|
| 1 | 71.1 | 60.8 |
| 10 | 54.7 | 40.8 |
| 20 | 49.6 | 34.8 |
| 31.25 | 46.3 | 30.9 |
| 100 | 37.6 | 20.8 |
| 150 | 34.5 | 17.3 |
| 200 | 32.3 | 14.8 |
| 250 | 30.6 | 12.9 |

### Category 6 Channel – Maximum Attenuation, Minimum Pair-to-Pair ACR and Power Sum ACR

Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | ATTENUATION (dB) | PAIR-TO-PAIR ACR (dB) | POWER SUM ACR (dB) |
|---|---|---|---|
| 1 | 2.1 | 71.4 | 68.9 |
| 10 | 6.3 | 51.0 | 48.4 |
| 20 | 9.0 | 43.4 | 40.6 |
| 31.25 | 11.3 | 37.8 | 35.0 |
| 100 | 20.6 | 19.9 | 16.7 |
| 150 | 26.1 | 11.4 | 8.5 |
| 200 | 30.6 | 4.8 | 1.8 |
| 250 | 34.6 | -1.0 | -4.0 |

### Category 6 Channel – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

| FREQUENCY (MHz) | RETURN LOSS (dB) |
|---|---|
| 1 to 20 | 19.0 |
| 25 | 18.0 |
| 31.25 | 17.1 |
| 62.5 | 14.1 |
| 100 | 12.0 |
| 150 | 10.2 |
| 200 | 9.0 |
| 250 | 8.0 |

## 15. INSTALLATION REQUIREMENTS

In order for unshielded twisted-pair cabling infrastructure to deliver high-speed performance, it is manufactured to very tight Specifications. Consequently, to maintain the unshielded twisted-pair cabling system performance proper installation practices must be followed. Listed below are some requirements that shall be followed:

- Never crush the cable (by over cinching with cable ties or by using a staple gun). Use of Velcro cable ties in the closets is required.
- Do not kink, knot or snag the cable while pulling, this will cause damage under the jacket and may alter cable performance.
- Do not to exceed the recommended pulling tension.

- Do not exceed the minimum bend of 4 x Outside Diameter (OD) for 4 pair UTP, 10 x OD for multi pair (more than 4 pair) UTP, 1.18 in. for two fiber cable, and 10 x OD for multi fiber cable.

- Per TIA/EIA 568-B and BICSI never un-twist the pairs of cable beyond the absolute minimum required for termination.

- The cable jacket on UTP shall only be stripped back the minimum required to terminate to connecting hardware.

- Cable management panels shall be used when terminating cable.

- Use the same performance criteria for both cable and connecting hardware through the entire horizontal run.

- Maximum cable lengths shall not be exceeded.

- Properly rated patch cables will be provided and tested. Silver satin linecord is not acceptable.

- A 40% fill ratio for all conduit runs is recommended (see Diagram 8).

- All fiber optic cables shall be set in inner-duct with the appropriate flame and smoke rating.

- All horizontal runs, moves, adds and changes must be documented. Use of a software package is recommended. Link and Channel test results must be provided.

- Connecting hardware for optical fiber installed at the following locations: main cross-connect, intermediate cross-connect, horizontal cross-connect, horizontal transition point, telecommunications outlet, shall not surpass minimum bend radius and shall be capable of storing 1m (3.28 ft.) of additional fiber.

- SC type connectors for fiber are recommended by TIA/EIA 568-B.3 (beige for multi-mode and blue for single mode). Users that have installed ST type fiber connectors may remain with them for both existing and future additions.

- The use of different colored icons for jacks (e.g., one for data, and one for voice) and different colored jacketed cables (which aide in cable identification and administration) are required.

- A single shared sheath at the outlet is not acceptable.

- Only one pin-out throughout the total installation (T568A or T568B) is allowed.

- Sizing of the house backbone cable (voice) will allow for a minimum of 2 pairs per station, allowing for 30% to 40% growth and rounding off to the next largest pair count cable (e.g., 250 pairs needed which includes growth, move to a 300 pair cable). Never specify smaller than 6 fibers in the backbone. Again, this is driven by the topology being implemented and should always allow for future growth.

- Reinstalling cable that has been pulled out of modular furniture is not allowed.

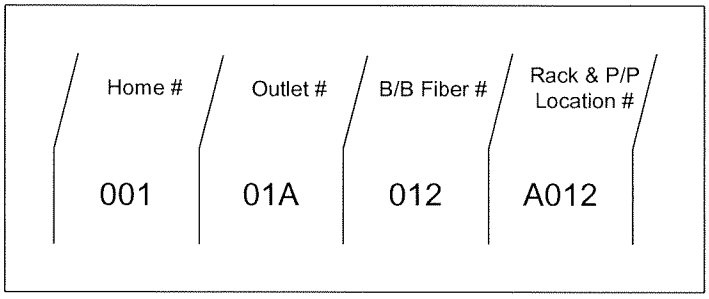
## 16. LABELING AND ADMINISTRATION

- Each cable shall be labeled.

- Each identifier shall be unique.

- Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).

- Example:




- Moves, adds or changes: all labels, records, and reports shall be updated.

- All pathways labeled (conduit, trays etc.).

- All dedicated telecommunications grounding bus bars shall be labeled.

## 17. BONDING AND GROUNDING

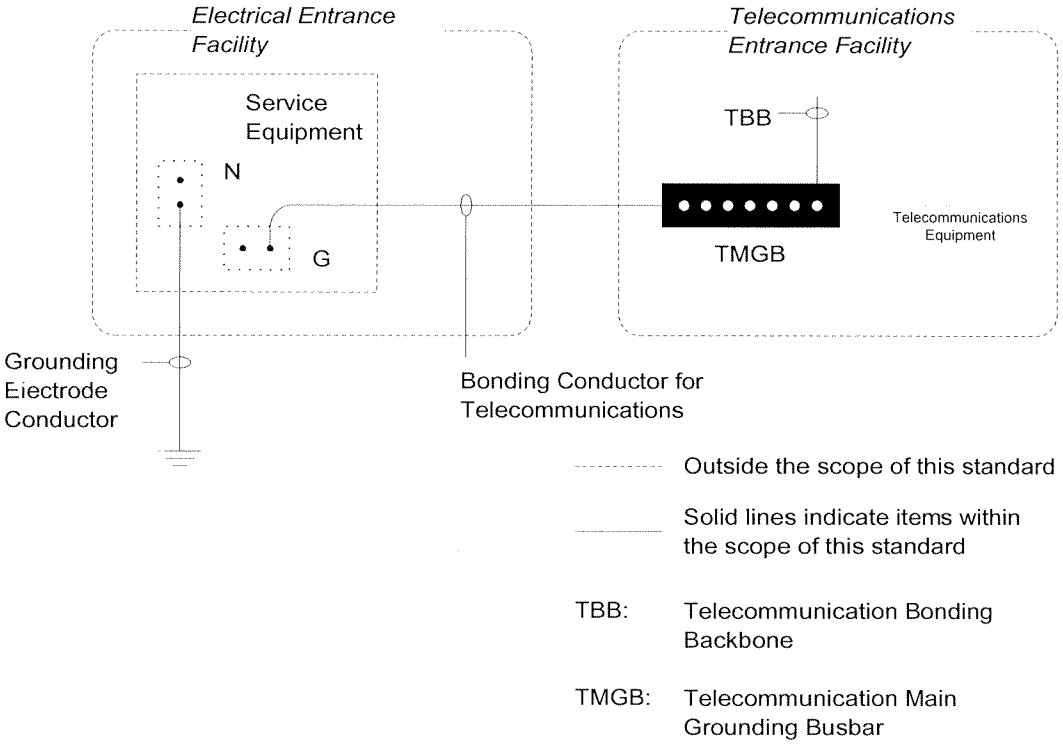
### Grounding

Grounding shall meet the requirements of the NEC and additionally grounding bonding shall conform with ANSI/TIA/EIA-607. For example see Diagram 7.

# Diagram 7
# Example TIA/EIA 607 Grounding

## Bonding to the service equipment (power) ground

The bonding conductor for telecommunications shall bond the TMGB to the service equipment (power) ground. The figure below schematically depicts connectivity to the service equipment (power) ground.




Schematic of connectivity to the service equipment (power) ground

## 18. TESTING, CERTIFICATION & WARRANTY

Testing of all installed "Basic Links" shall be performed using a Level e hand held tester and performed to the latest revision of TIA/EIA-568-B documents. All reports shall be recorded and presented to the end user before acceptance. This also includes all fiber runs that have been installed. Fiber will be tested for both wavelengths of multi mode and single mode fiber by power meter and light source.

### Testing

Testing of cabling shall be performed prior to system cut-over, 100 percent of the UTP horizontal and riser pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. UTP voice, data and building control device horizontal wiring pairs shall be tested to the latest version of the TIA/EIA-568-B documents. from the information outlet to the TC and from the TC to the information outlet. In addition, all assigned circuits shall be tested from the information outlet/building control device to the MDF.

### Workmanship

Components of the premise distribution system shall be installed in a neat, orderly manner consistent with the best telephone and data installation practices. Wiring color codes shall be strictly observed and termination shall be uniform throughout. Identification marking and systems shall be uniform, permanent and readable and in accordance with TIA/EIA-606 Specifications. TIA/EIA 568-B.1 wiring codes as shown on the drawings shall Specificationize all twisted pair wiring.

### Inspection

On-going inspections shall be performed during construction by the City of Loma Linda Project Manager and Installation Project Managers. All work shall be performed in a high quality craftsman manner and the overall appearance shall be clean, neat and orderly. The following points will be examined:

- Is the design documentation complete? Are all cables properly labeled from end-to-end?
- Have all terminated cables been properly tested in accordance with the Specifications for the required performance Level as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
- Is the cable type suitable for its pathway? Are the cables bundled in parallel?
- Have the pathway manufacturer's guidelines been followed? Are all cable penetrations installed properly and fire stopped according the code?

- Have the contractors avoided excessive cable bending?
- Have potential EMI and RFI sources been considered?
- Is Cable Fill correct?
- Are hanging supports within 1.5 meters (5 ft)?
- Does hanging cable exhibit some sag?
- Are telecommunications closet terminations compatible with applications equipment?
- Have Patch Panel instructions been followed?
    a) jacket removal point
    b) termination positions
    c) all pair terminations tight with minimal pair distortions
    d) twists maintained up to the Index Strip
- Have Modular Panel instructions been followed?
    a) cable dressing first
    b) jackets remain up to the Connecting Block
    c) all pair terminations tight and undistorted
    d) twists maintained up to the Connecting Block
- Are the correct outlet connectors used and turned right side up?
- Are identification markings uniform, permanent and readable?

### Warranty

Product Warranty and System Assurance Warranty for this Structured Cabling System shall be provided. Upon successful completion of the installation and subsequent testing by the installer and City of Loma Linda, City of Loma Linda shall be provided with a Warranty certificate registering the installation by Berk Tek and Ortronics.

## 19. SCOPE OF WORK

Scope of Work to be created and supplied by Anixter, Inc. for each individual development.

## 20. BILL OF MATERIALS See Attached Material List

Bill of Materials to be created and supplied by Anixter, Inc., for each individual development.

## 21. BUILDING/PLAN CHECK

Submit plans showing compliance with design standards as outlined in Resolution No. _____. Plans shall show location of:

- All Distribution Center Boxes
- All jack locations
- Materials to be used in compliance with Resolution # _____

## 22. PUBLIC WORKS/PLAN CHECK

Any and all work in the Public right-of-way (R-O-W) or proposed Public right-of-way requires a Public Works permit. A Public permit will be issued based upon a plan, approved by the City, showing all work proposed in the R-O-W.

## 23. CONTRACTOR QUALIFICATIONS

- The selected Contractor shall be a recognized Anixter "Levels" Partner Contractor, certified by manufacturer: **Berk Tec/Ortronics/Corning**.

- The Contractor must be fully capable and have a minimum of five (5) years of experience in the design and installation of the telecommunications distribution system proposed.

- To ensure the system has continued support, **City of Loma Linda** will contract only with Contractors having a successful history of sales, installation, service, and support. During the evaluation process, **City of Loma Linda**, may, with full cooperation of The Contractors, visit The Contractors' places of business, observe operations, and inspect records.

- A minimum of 50% of the staff assigned to this project by The Contractor, must be certified by the associated manufacturer in the installation of the proposed system.

- All staff assigned to this project by The Contractor must wear shirts with The Contractor's logo at all times.

- **City of Loma Linda**, may, with full cooperation of The Contractors, visit client installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through The Contractors, with Contractor personnel present during these discussions.

- The Contractor must provide a minimum of two (2) reference accounts at which similar work, both in size and scope, have been completed by The Contractor within the last two (2) years and one (1) reference account of similar size and scope that is currently in progress.

## 24. APPROVED CONTRACTORS

The following Contractors are approved to bid all work associated with the Loma Linda Connected Community Program:

- Enterprise Electric
  Mr. Dan DeWitt - (909) 296-1530

- Volt Telecom
  Mr. John Bettis - (909) 578-9665

- Pacific Coast Cabling
  Mr. Tim McManus - (818) 407-1911

- Vector
  Mr. Robert Messinger - (310) 436-1000

- Compel
  Mr. Rick Strattford – (562) 926-0900

- CCCI West
  Mr. Jeff Stanley – (714) 606-2915

# ANIXTER

## Loma Linda Connected Community Program

Estimated Bill of Materials

### Cabling Infrastructure Materials

| Qty | Item | Anixter Part # | Vendor Part # | Category | Vendor | Description | Color |
|---|---|---|---|---|---|---|---|
| | kft | CM-00424BKTE-7-06 | 10033817 | 6 | Berk-Tek | LANmark 2000 | Blue |
| | each | 9L0660BTQS-02 | 10058001 | n/a | Berk-Tek | RG6 75 ohm Quad shield | Black |
| | each | 207271 | OR 854045330 | n/a | Ortronics | 3 port flush mount single gang faceplate | White |
| | each | SYN234143 | TJ600-88 | 6 | Ortronics | 1 port jack module | White |
| | each | 256055 | OR 63700006-88 | n/a | Ortronics | 1 port F-type insert | White |
| | each | 237252 | GF-360-6Q | n/a | Gilbert | F connector 360 degree crimp seal | n/a |
| | lot | n/a | n/a | n/a | n/a | misc. cable support hardware | n/a |
| | lot | n | n/a | n/a | n/a | misc. hardware | n/a |

### Residence Distribution Center Box Materials

| Qty | Item | Anixter Part # | Vendor Part # | Category | Vendor | Description | |
|---|---|---|---|---|---|---|---|
| | each | N/S | OR 42400019 | n/a | Ortronics | 36" galvanized steel enclosure | steel |
| | each | N/S | EP03-194 | 6 | Ortronics | 24 port station panel host | n/a |
| | each | 248409 | OR 866045650 | n/a | Ortronics | Enhanced voice/data host panel | n/a |
| | each | N/S | OR 866845686 | n/a | Ortronics | Video Panel | n/a |
| | each | N/S | OR 7080058 | n/a | Ortronics | Fiber ring clamp | n/a |
| | each | 237252 | GF-360-6Q | n/a | Gilbert | F connector 360 degree crimp seal | n/a |
| | lot | n/a | n/a | n/a | n/a | misc. cable support hardware | n/a |
| | lot | n | n/a | n/a | n/a | nisc hardware | n/a |

### Fiber Optic Backbone Cabling Materials

| Qty | Item | Anixter Part # | Vendor Part # | Level | Vendor | Description | Color |
|---|---|---|---|---|---|---|---|
| | each | | (SCF-6C22-01-F) | n/a | Corning | Advanced Splice Closure, 6"x22", capacity for four 0.4" reduced length splice trays. Capacity for splicing up to 96 fibers using four 24-fiber trays. Equipped with slack storage basket. | n/a |
| | each | | (SCF-KT-G62-F) | n/a | Corning | 2-Hole Grommet Kit for installation of one or two 5 mm x 10 mm flat drop cables in 6" diameter SCF splice closure. | n/a |
| | each | | (SCF-ST-116) | n/a | Corning | Fusion Splice Tray (0.4"), 24 fiber capacity, heat shrink, reduced length, 8.75" in length. | n/a |
| | each | | (2806031-01) | n/a | Corning | Fusion Splice Heat Shrink, Single Fiber, 60 mm Length, 50 per Pack | n/a |
| | each | | (FNI-79-1BB-1) | n/a | Corning | Fiber Network Interface (FNI) Housing with capacity for splicing and patching between outside plant drop cable and inside plant interconnect cable. | n/a |
| | each | | (005801R3131001M | n/a | Corning | Single Fiber Pigtail with SC/UPC connector on one end. 2.9 mm jacket. Single-mode. 1 meter in length. | n/a |
| | each | | (585801R3131050F) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 50 feet in length. | n/a |
| | each | | (585801R3131100F) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 100 feet in length. | n/a |
| | each | | (585801R3131150F) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 150 feet in length. | n/a |
| | each | | (G2436-18) | n/a | Corning | Medium Duty Fiber Optic Vault Body, 24" x 36" x 18" deep, HDPE construction. | n/a |
| | each | | (G2436-8X) | n/a | Corning | Medium Duty Fiber Optic Vault Body Extension, 8" deep, HDPE construction. | n/a |
| | each | | (G2436-PR) | n/a | Corning | Medium Duty Fiber Optic Vault Adapter Ring for Cover, Polymer Concrete construction. | n/a |
| | each | | (G2436-PC) | n/a | Corning | Medium Duty Fiber Optic Vault Cover, Polymer Concrete construction. | n/a |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | each | | (072RW4-T4101A20) | n/a | Corning | ALTOS All Dielectric Cable, 72-fiber 0.4/0.3B/km | n/a |
| | each | | (060RW4-T4101A20) | n/a | Corning | ALTOS All Dielectric Cable, 60-fiber 0.4/0.3 B/km | n/a |
| | each | | (048RW4-T4101A20) | n/a | Corning | ALTOS All Dielectric Cable, 48-fiber 0.4/0.3 B/km | n/a |
| | each | | (024RW4-T4101A20 | n/a | Corning | ALTOS All Dielectric Cable, 24-fiber 0.4/0.3 dB/km | n/a |
| | each | | (012RW4-T4101A20 | n/a | Corning | ALTOS All Dielectric Cable, 12-fiber 0.4/0.3 dB/km | n/a |
| | each | | (001RB4-T4101A20) | n/a | Corning | SST All Dielectric Drop Cable, 1-fiber 0.4/0.3 dB/km | n/a |

**Control Building Materials**

| Qty | Item | Anixter Part # | Vendor Part # | Level | Vendor | Description | Color |
|---|---|---|---|---|---|---|---|
| | each | | ECL-BAY-7 | n/a | Corning | Eclipse 19" network bay frame with top and bottom jumper troughs | n/a |
| | each | | (ECL-IBU-7-1) | n/a | Corning | Eclipse Interbay Storage Unit for vertical routing and management of jumpers. | n/a |
| | each | | (ECL-J2U) | n/a | Corning | Eclipse Jumper Management Panel for horizontal routing and management of jumpers, 2 rack spaces. | n/a |
| | each | | (UDF-IEC-7-75) | n/a | Corning | End Cap for Eclipse Frame. | n/a |
| | each | | (ECL72P06-3C-6RR000) | n/a | Corning | Eclipse Connector Housing with factory installed pigtails for 72 fibers. A total of 12 connector panels with 6 fibers per panel will be installed. Fiber will be single-mode in 6-fiber MIC cable pigtails 6 meters long each. Connector Housing is 4 rack spaces in height. | n/a |
| | each | | (ECL60P06-3C-6RR000) | n/a | Corning | Eclipse Connector Housing with factory installed pigtails for 60 fibers. A total of 10 connector panels with 6 fibers per panel will be installed. Fiber will be single-mode in 6-fiber MIC cable pigtails 6 meters long each. Connector Housing is 4 rack spaces in height. | n/a |
| | each | | (ECL48P06-3C-6RR000) | n/a | Corning | Eclipse Connector Housing with factory installed pigtails for 48 fibers. A total of 8 connector panels with 6 fibers per panel will be installed. Fiber will be single-mode in 6-fiber MIC cable pigtails 6 meters long each. Connector Housing is 4 rack spaces in height. | n/a |
| | each | | (ECL-S4U) | n/a | Corning | Eclipse Splice Housing with capacity for twelve 0.2" tall splice trays. Splice Housing is 4 rack spaces in height. | n/a |
| | each | | (M67-048) | n/a | Corning | Fusion Splice Tray (0.2"), 12 Fiber Capacity, Heat Shrink. Tray is 11.7" in length. | n/a |
| | each | | (2806031-01) | n/a | Corning | Fusion Splice Heat Shrink, Single Fiber, 60 mm Length, 50 per Pack | n/a |
| | each | | (585801R3131001M) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 1 meter in length. | n/a |
| | each | | (585801R3131003M) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 3 meter in length. | n/a |
| | each | | (585801R3131005M) | n/a | Corning | Single Fiber Patch Cord with SC/UPC connectors on both ends. 2.9 mm jacket. Single-mode. 5 meter in length. | n/a |
| | each | | | n/a | ortronics | 19" X 7' open equipment rack | n/a |
| | each | | | n/a | Ortronics | 23" X 84" enclosed cabinet | n/a |
| | each | | | n/a | CPI | 12" X 10' ladder rack | n/a |
| 1 | lot | | | n/a | CPI | Misc. Ladder Rack hardware | n/a |